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PATENT ABSTRACTS OF JAPAN

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ENDO MASAMICHI(54) CONTINUOUS PRODUCTION METHOD FOR IMIDE GROUP CONTAINING
COPOLYMER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a method for continuously producing, in a high yield, an imide group containing copolymer which is excellent in thermal stability and color tone, and has a low total volatile content.

SOLUTION: This method comprises the first step of continuous multi-step polymerization, the second step of continuous multi-step imide ring formation, and the third step of continuous evaporation of solvents.

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CLAIMS

[Claim(s)]

[Claim 1] The continuous manufacture approach of the imide-ized copolymer characterized by for the ratios (Mw/Mn) of 2.0 or less, weight average molecular weight, and number average molecular weight being [for YI of a 4wt% tetrahydrofuran solution of the imide-ized copolymer obtained by carrying out continuously the first process, the second following process, and the third following process (yellow index)] 2.0-3.0, and the total volatile matter being 1,000 ppm or less.

The first process: The process which carries out the multistage continuation polymerization of 45 - 80 % of the weight of aromatic series vinyl monomers, 20 - 50 % of the weight of partial saturation dicarboxylic acid anhydride monomers, and these monomers and 0 - 30 % of the weight of copolymerizable vinyl monomers at the temperature of 60-200 degrees C among an aliphatic series ketone solvent, and carries out the polymerization of the conversion of an aromatic series vinyl monomer and a partial saturation dicarboxylic acid anhydride monomer to 95% of the weight or more, respectively.

The second process: The process which ammonia and/or primary amine are added [process] continuously, makes more than 70 mol % of the partial saturation dicarboxylic acid anhydride monomer residue in the copolymer multistage-continuation-imide--ization-react with the reaction temperature of 120-250 degrees C, and makes the conversion of the added ammonia and/or primary amine react to the polymerization liquid obtained at the first process more than 95 mol %.

The third process: The process which removes volatile matter by devolatilizing continuously the reaction mixture obtained at the second process under 180-330 degrees C and reduced pressure.

[Claim 2] The approach according to claim 1 that an aromatic series vinyl monomer is characterized by styrene and a partial saturation dicarboxylic acid anhydride monomer being [a maleic anhydride, ammonia, and/or primary amine] anilines.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the manufacture approach of an imide-ized copolymer. Furthermore, if it says in detail, it consists of a solution multistage continuation polymerization process, a multistage continuation imide-ized reaction process, and a continuation devolatilization process that follows it, and is related with the approach of obtaining the imide-ized copolymer with which thermal stability and a color tone were improved by stability with a high invert ratio. Since the imide-ized copolymer of this invention has high thermal resistance and the imide-ized copolymer concerned has good compatibility in the blend with other various resin importantly as weak

electric current and OA components, or autoparts, the application is spreading increasingly.

[0002]

[Description of the Prior Art] In the radical copolymerization reaction of styrene and a maleic anhydride, since styrene and a maleic anhydride are configurated by turns, they tend (J. 67 Am. Chem. Soc., 2044 (1945)) to generate an alternating copolymer. Therefore, in order to obtain the copolymer of a presentation ratio for which it asks by uniform presentation, while the monomer ratio of concentration in a polymerization system changes the rate of styrene and a maleic anhydride according to a polymerization invert ratio and adds continuously so that it may become fixed substantially to the polymerization body composition finally acquired, the approach of carrying out a continuation polymerization is learned (JP,58-11514,A). However, by this approach, in order to have made the polymerization invert ratio 90% or more, holding a copolymer presentation to homogeneity, there were various problems -- polymerization time amount cuts in long duration.

[0003] Moreover, after carrying out heating fusion of an aromatic series vinyl compound and the copolymer containing a maleic anhydride and making amines react continuously, the continuation imide-ized approach of removing volatile matter is also learned (JP,58-180506,A, JP,2-4806,A, JP,6-56921,A, JP,9-100322,A). However, there was a problem of color tone degradation resulting from if the thermal stability of the imide-ized copolymer obtained since the presentation of the copolymer which contains the aromatic series vinyl compound of a raw material and a maleic anhydride in these approaches is an ununiformity is not enough, the residual amines by the conversion of an imide-ized reaction being low etc. Furthermore, by the approach of carrying out melting kneading and imide-izing in an extruder, since the amount of the amines to add was the amount of two to 3 times of a maleic-anhydride residue content, the unreacted amine remained so much and there were problems, such as making indispensable the complicated process which carries out separation playback of the unreacted object.

[0004]

[Problem(s) to be Solved by the Invention] This invention aims at offering the approach of not having the above-mentioned fault. That is, it is related with the approach that thermal stability and the good imide-ized copolymer of a color tone can be manufactured with a high invert ratio.

[0005]

[Means for Solving the Problem] this invention persons had the good color tone wholeheartedly as a result of research, and how thermal stability obtains the higher imide-ized copolymer of high quality advantageously industrially was found out. namely, YI of a 4wt% tetrahydrofuran solution of the imide-ized copolymer obtained when this invention carried out continuously the first process, the second following process, and the third following process (yellow index) -- the ratio of 2.0 or less, weight average molecular weight, and number average molecular weight -- it consists in the continuous manufacture approach of the imide-ized copolymer characterized by for M_w/M_n being 2.0-3.0 and the

total volatile matter being 1,000 ppm or less.

The first process: The process which carries out the multistage continuation polymerization of 45 - 80 % of the weight of aromatic series vinyl monomers, 20 - 50 % of the weight of partial saturation dicarboxylic acid anhydride monomers, and these monomers and 0 - 30 % of the weight of copolymerizable vinyl monomers at the temperature of 60-200 degrees C among an aliphatic series ketone solvent, and carries out the polymerization of the conversion of an aromatic series vinyl monomer and a partial saturation dicarboxylic acid anhydride monomer to 95% of the weight or more, respectively.

The second process: The process which ammonia and/or primary amine are added [process] continuously, makes more than 70 mol % of the partial saturation dicarboxylic acid anhydride monomer residue in the copolymer multistage-continuation-imide--ization-react with the reaction temperature of 120-250 degrees C, and makes the conversion of the added ammonia and/or primary amine react to the polymerization liquid obtained at the first process more than 95 mol %.

The third process: The process which removes volatile matter by devolatilizing continuously the reaction mixture obtained at the second process under 180-330 degrees C and reduced pressure.

[0006] The first process in this invention is a process to which the multistage continuation polymerization of an aromatic series vinyl monomer, a partial saturation dicarboxylic acid anhydride monomer, and these monomers and a copolymerizable vinyl monomer is carried out in an aliphatic series ketone solvent. The multistage polymerization as used in the field of this invention has at least five or more steps of desirable polymerizations, and the polymerization of them is carried out by multistage ***** equipment in the polymerization space in which it is moderately isolated with a batch, and complete mixing is carried out, and it deals. A partial saturation dicarboxylic acid anhydride is added by each polymerization space according to the consumption by the polymerization of monomers including an aromatic series vinyl monomer. In this case, a partial saturation dicarboxylic acid anhydride has a convenient solution by the same aliphatic series ketone solvent as a polymerization solvent. The addition ratio of a partial saturation dicarboxylic acid anhydride is based on the well-known quantitative ratio for making the presentation of the copolymer obtained into homogeneity. That is, it is the approach of changing the rate of a partial saturation dicarboxylic acid anhydride according to a polymerization invert ratio, and adding so that the monomer ratio of concentration in a polymerization system may become fixed substantially to the polymerization body composition finally acquired.

[0007] what divided the interior of the usual polymerization can with the dashboard as multistage polymerization equipment, the thing which arranged the polymerization can in the serial by the cascade method, and a column -- a polymerization with the batch of a type -- there is a column. As for these, it is desirable that churning mixing is carried out in each polymerization space. moreover, a column in order to complete a polymerization more at the last of these polymerization equipment -- the postreactor of a type may be used.

[0008] It is an aromatic series vinyl-partial saturation dicarboxylic acid anhydride by said multistage polymerization. - The thing of the presentation with the uniform copolymer which consists of copolymerizable vinyl is obtained, and conversion with each high monomer is attained. When presentation distribution of the copolymerization ratio of a partial saturation dicarboxylic acid anhydride is large in the copolymer especially obtained when the presentation of a copolymer was not uniform, the thermal stability of the last imide-ized copolymer becomes less enough. Moreover, if it says further when conversion is less than 95 % of the weight, when the conversion of a partial saturation dicarboxylic acid anhydride will be less than 95 % of the weight, in the second following process, this non-polymerization monomer forms an imide-ized monomer, and degrades the color tone of the last imide-ized copolymer remarkably.

[0009] As an aromatic series vinyl monomer used at the first process, although there are styrene, alpha methyl styrene, vinyltoluene, ethyl styrene, tertiary butyl styrene, chloro styrene, dichloro styrene, etc., styrene is the most desirable. The amount of an aromatic series vinyl monomer is 45 - 80 % of the weight, and is 50 - 75 % of the weight preferably. When the amount of an aromatic series vinyl monomer is less than 45 % of the weight, the mechanical characteristic, the last dimensional stability, and the last color tone of an imide-ized copolymer serve as a defect. When the amount of an aromatic series vinyl monomer exceeds 80 % of the weight, thermal resistance becomes moreover, less enough.

[0010] As a partial saturation dicarboxylic acid anhydride monomer, although there are a maleic-acid anhydride and an alkylation mallein anhydride, especially a maleic-acid anhydride is desirable. The amount of a partial saturation dicarboxylic acid anhydride monomer is 20 - 50 % of the weight, and is 25 - 50% preferably. When the amount of a partial saturation dicarboxylic acid anhydride monomer is less than 20 % of the weight, if the thermal resistance of the last imide-ized copolymer exceeds 50 % of the weight rather than is enough, a problem will be produced in a color tone and thermal stability.

[0011] There are acrylonitrile, a methacrylonitrile, a methyl methacrylate, ethyl methacrylate, a methyl acrylate, an ethyl acrylate, and n-butyl acrylate as these monomers and a copolymerizable vinyl monomer, and those amounts are 0 - 30 % of the weight. Although an imide-ized copolymer has highly useful thermal resistance, depending on the case, there are a mechanical strength and a case of being dissatisfied, with chemical resistance. In order to improve these, the plural copolymers using said monomer as a copolymerizable vinyl monomer are useful. When the amount of a copolymerizable vinyl monomer exceeds 30 % of the weight, thermal resistance becomes however, less enough.

[0012] The polymerization temperature in the first process is 60-200 degrees C, and is 80-150 degrees C preferably. Rate of polymerization sufficient at less than 60 degrees C is not obtained, and it is not economically desirable. If polymerization temperature exceeds 200 degrees C, sufficient molecular weight will not be obtained. Although there are an acetone, a methyl ethyl ketone, and methyl isobutyl ketone as an aliphatic series ketone solvent used here, methyl

isobutyl ketone is preferably used from the ease of dealing with it, such as volatility.

[0013] In the polymerization in the first process, about the radical initiator used, there is especially no limit and what is regularly used in manufacture of conventional styrene resin, for example, organic peroxide and the azo system compound whose 10-hour half-life is 70-120 degrees C, is used suitably. For example, t-butylperoxyisopropylcarbonate, 1, and ~~1-screw~~ (tert-butyl peroxide) - 3, 3, a 5-trimethyl cyclohexane, azo-isobutyro-dinitrile, azobis dimethylvaleronitrile, etc. are desirable. These initiators are the quantitative ratios of common knowledge to this contractor, namely, are used at 0.001 - 1.0% of the weight of a rate to the total quantity of a monomer. Furthermore a polymerization faces and a well-known molecular weight modifier, a plasticizer, a thermostabilizer, an antioxidant, etc. may be added if needed.

[0014] The second process in this invention is a process to which introduce into a multistage reactor, more than 70 mol % of the partial saturation dicarboxylic acid anhydride monomer residue in the copolymer is made to multistage-continuation-imide--ization-react to, and the conversion of the added ammonia and/or primary amine is made to react more than 95 mol %, after adding ammonia and/or primary amine continuously in the polymerization liquid obtained at the first process. With the multistage continuation imide-ized reaction as used in the field of this invention, at least three or more steps of reactions are desirable, and they react with the equipment which had in multistage the reaction space in which it is moderately isolated with a batch, and complete mixing is carried out, and it deals. In order to imide-ize a copolymer to homogeneity and to raise the conversion of ammonia and/or primary amine, it is important that reaction mixture does not flow backwards between each reaction space substantially.

[0015] Imide-ization of the partial saturation dicarboxylic acid anhydride monomer residue in a copolymer becomes inadequate [the thermal resistance of the last imide-ized copolymer, and thermal stability] at said reaction for it to be less than [70 mol %]. Moreover, if it is also important that the copolymer is imide-ized by homogeneity and an imide-ized copolymer with the low rate of imide-izing mixes, thermal stability and a color tone will fall. Furthermore, when the conversion of ammonia and/or primary amine is less than [95 mol %], in the third following process, unreacted ammonia and/or the by-product from primary amine arise, and it becomes the cause of color tone degradation of the last imide-ized copolymer.

[0016] what divided the interior of the usual reaction can with the dashboard as a multistage continuation imide-ized reactor, the thing which arranged the reaction can in the serial by the cascade method, and a column -- there is a reactor with the batch of a type. As for these, it is desirable that churning mixing is carried out in each reaction space. moreover, a column in order to complete a reaction more at the last of these reactors -- the postreactor of a type may be used.

[0017] The reaction temperature in the second process is 120-250 degrees C, and is 170-230 degrees C preferably. In the case of less than 120 degrees C, a

reaction rate is slow, and it is not economically desirable. [of a reaction rate] If 230 degrees C is exceeded, decomposition and side reaction of ammonia and/or primary amine start and are not desirable.

[0018] Below the equivalence of the partial saturation dicarboxylic acid anhydride monomer used at the first process of the ammonia to be used and/or the amount of primary amine is desirable, and the superfluous amount used causes color tone degradation of the last imide-ized copolymer. As ammonia and/or primary amine, as monomethylamine, ethylamine, n propylamine, isopropylamine, a butylamine, cyclohexylamine, a stearyl amine, benzylamine, and aromatic amine, there are an aniline, an ORUTO toluidine, 2 and 4, 6-TORIKURORO aniline, alpha-naphthylamine, beta-naphthylamine, methoxyaniline, an ethoxy aniline, etc. as fatty amine other than ammonia, and especially an aniline is desirable.

[0019] In the imide-ized reaction in the second process, even if it uses a catalyst, it is not necessary to use. It is desirable to use a catalyst to gather a reaction rate and conversion further. As a catalyst, there is tertiary amine, for example, there are a trimethylamine, triethylamine, etc. The amount in the case of using is 0.01 - 2.0 % of the weight to ammonia and/or primary amine.

[0020] The third process in this invention is a process which removes volatile matter by devolatilizing continuously the reaction mixture obtained at the second process under 180-330 degrees C and reduced pressure. It becomes [devolatilization takes long duration as processing temperature is less than 180 degrees C, or / a handling object] hyperviscosity and is inconvenient. If 330 degrees C is exceeded, disassembly of a processing object etc. starts and is not desirable. As a devolatilizer used at the third process, there are a well-known biaxial extruder, a strand devolatilizer, etc. in this industry.

[0021] The imide-ized copolymer obtained by carrying out continuously said first process, the second process, and the third process is excellent in thermal stability and a color tone, and the ratios (Mw/Mn) of weight average molecular weight and number average molecular weight are 2.0-3.0, and the total volatile matter is a thing 1,000 ppm or less. Since the continuous manufacture approach by this invention is a high invert ratio in a polymerization and an imide-ized reaction, there are few ***** and side reaction products, and its total volatile matter also decreases inevitably.

[0022] Although you may use independently, the imide-ized copolymer obtained by this invention is blended with ABS plastics, AAS resin, AES resin, MBS resin, etc., and a moldability, shock resistance nature, etc. can be used for it, improving them further. Moreover, the compatibility of engineering plastics, such as a polycarbonate and nylon, is good, and they can be used preferably.

[0023] In the copolymer which is the above, and was made and obtained, or its blend object, a well-known antioxidant, a plasticizer, lubricant, an ultraviolet ray absorbent, a flame retarder, an antistatic agent, and various bulking agents can be added if needed.

[Embodiment of the Invention]

[0024]

[Example] Hereafter, although an example explains this invention still more

concretely, this invention is not limited to these examples.

[0025] In addition, the measuring method of the conversion of the polymerization liquid before imide-izing and YI after imide-izing (yellow index), molecular weight, molecular weight distribution, the total volatile matter, and the last presentation ratio is as follows.

(1) Conversion of polymerization liquid : thump RIMBU of the polymerization liquid after the first process termination was carried out, the gas chromatography performed the quantum of an unreacted monomer for the polymerization liquid, and conversion was computed.

(2) YI (yellow index) : it asked with the color difference meter using the 4 wt/THF(tetrahydrofuran) vol% solution of the imide-ized copolymer after the third process termination.

(3) molecular weight and molecular-weight-distribution: -- the imide-ized copolymer after the third process termination -- GPC (gel permeation chromatography) -- it asked with the value of polystyrene conversion by law.

(4) The total volatile matter : the small quantity of the imide-ized copolymer after the third process termination was sampled, under the vacuum, it processed for 1 hour and 220 degrees C was computed from the loss-in-quantity value.

(5) The last presentation ratio : it asked for the invert ratio to the NPMI (N-phenyl maleimide) radical of a maleic-anhydride radical by law 13 C-NMR (nuclear magnetic resonance), and the last presentation ratio was computed from the result of (1), and this invert ratio.

[0026]

[Example 1] Styrene 0.37kg/hr., and maleic-anhydride solution (maleic-anhydride / methyl-isobutyl-ketone / benzoyl peroxide =14/86/0.15 (weight ratio)) 0.86 kg/hr. The volume introduces into the 1st polymerization can of 5L, carry out a polymerization at 85 degrees C, and the volume leads to the lower part of the three-step type 2nd polymerization can of 16L. Maleic-anhydride solution (maleic-anhydride / methyl-isobutyl-ketone / benzoyl peroxide =14/86/0.15 (weight ratio)) 0.10kg/hr., Addition mixing of 0.10kg/hr. and 0.09 kg/hr. was carried out to the lower berth, the middle, and an upper case, respectively, and the polymerization was advanced at 85 degrees C, and also the polymerization was carried out at 85 degrees C by the pipe reactor of 3L. After adding continuously an aniline / triethylamine =97/3 (weight ratio) mixture 0.145 kg/hr. to 1.52kg of polymerization liquid, and obtained hr., the mixture was introduced into the lower part of the three-step type imide-ized reactor of volume 16L, and imide-ization was performed at 140 degrees C. The obtained imide-ized solution was introduced to the extruder with a vent, and the polymer, the unreacted monomer, and the solvent were separated by 310 degrees C and 30torr. The conversion of the polymerization liquid before imide-izing, YI (yellow index) of the obtained imide-ized copolymer, molecular weight, the total volatile matter, and the last presentation ratio were measured, respectively.

[0027]

[Example 2] Styrene 0.33kg/hr., and maleic-anhydride solution (maleic-anhydride / methyl-isobutyl-ketone / benzoyl peroxide =16/84/0.17 (weight ratio)) 0.94 kg/hr. The volume introduces into the 1st polymerization can of 5L,

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carry out a polymerization at 85 degrees C, and the volume leads to the lower part of the three-step type 2nd polymerization can of 16L. Maleic-anhydride solution (maleic-anhydride / methyl-isobutyl-ketone / benzoyl peroxide =16/84/0.17 (weight ratio)) 0.11kg/hr., Addition mixing of 0.10kg/hr. and 0.10 kg/hr. was carried out to the lower berth, the middle, and an upper case, respectively, and the polymerization was advanced at 85 degrees C, and also the polymerization was carried out at 85 degrees C by the pipe reactor of 3L. After adding continuously an aniline / triethylamine =97/3 (weight ratio) mixture 0.186 kg/hr. to obtained polymerization liquid 1.58 kg/hr., the mixture was introduced into the three-step type imide-ized reactor of volume 16L, and imide-ization was performed at 140 degrees C. The obtained imide-ized solution was introduced to the extruder with a vent, and the polymer, the unreacted monomer, and the solvent were separated by 310 degrees C and 30torr. The conversion of the polymerization liquid before imide-izing, YI (yellow index) of the obtained imide-ized copolymer, molecular weight, the total volatile matter, and the last presentation ratio were measured, respectively.

[0028]

[Example 3] Styrene 0.30kg/hr., methyl-methacrylate 0.02kg/hr., and maleic-anhydride solution (maleic-anhydride / methyl-isobutyl-ketone / benzoyl peroxide =17/83/0.18 (weight ratio)) 0.88 kg/hr. The volume introduces into the 1st polymerization can of 5L, carry out a polymerization at 85 degrees C, and the volume leads to the lower part of the three-step type 2nd polymerization can of 16L. Maleic-anhydride solution (maleic-anhydride / methyl-isobutyl-ketone / benzoyl peroxide =17/83/0.18 (weight ratio)) 0.12kg/hr., Addition mixing of 0.12kg/hr. and 0.11 kg/hr. was carried out to the lower berth, the middle, and an upper case, respectively, and the polymerization was advanced at 85 degrees C, and also the polymerization was carried out at 85 degrees C by the pipe reactor of 3L. After adding continuously an aniline / triethylamine =97/3 (weight ratio) mixture 0.196 kg/hr. to obtained polymerization liquid 1.55 kg/hr., the mixture was introduced into the three-step type imide-ized reactor of volume 16L, and imide-ization was performed at 140 degrees C. The obtained imide-ized solution was introduced to the extruder with a vent, and the polymer, the unreacted monomer, and the solvent were separated by 310 degrees C and 30torr. The conversion of the polymerization liquid before imide-izing, YI (yellow index) of the obtained imide-ized copolymer, molecular weight, the total volatile matter, and the last presentation ratio were measured, respectively.

[0029]

[The example 1 of a comparison] The volume introduced styrene 0.37kg/hr., and maleic-anhydride solution (maleic-anhydride / methyl-isobutyl-ketone / benzoyl peroxide =14/86/0.15 (weight ratio)) 1.15 kg/hr. into the polymerization can which does not have a batch in the interior of 20L, and carried out the polymerization at 85 degrees C. Obtained polymerization liquid 1.52kg/hr. and aniline 0.14kg/hr., and triethylamine 0.005 kg/hr. were introduced into the imide-ized reactor which does not have a batch in the interior of volume 15L, and imide-ization was performed at 140 degrees C. The obtained imide-ized solution was introduced to the extruder with a vent, and the

polymer, the unreacted monomer, and the solvent were separated by 310 degrees C and 30torr. The conversion of the polymerization liquid before imide-izing, YI (yellow index) of the obtained imide-ized copolymer, molecular weight, the total volatile matter, and the last presentation ratio were measured, respectively.

[0030]

[The example 2 of a comparison] It is a styrene solution (after teaching styrene / methyl-isobutyl-ketone =40/60 (weight ratio) 60.7kg and heating at 85 degrees C, the batch polymerization of the 39.3kg (maleic-anhydride / methyl-isobutyl-ketone / benzoyl peroxide =27/73/0.29 (weight ratio)) of the maleic-anhydride solutions was added and carried out over 10 hours.) to a polymerization can. Per [which was obtained] polymerization liquid 90.9 weight section, the aniline 9.1 weight section, and the triethylamine 0.3 weight section were taught to the imide-ized reactor, and the batch imide-ized reaction was performed in 140 degrees C and 7 hours. The obtained imide-ized solution was introduced to the extruder with a vent, and the polymer, the unreacted monomer, and the solvent were separated by 310 degrees C and 30torr. The conversion of the polymerization liquid before imide-izing, YI (yellow index) of the obtained imide-ized copolymer, molecular weight, the total volatile matter, and the last presentation ratio were measured, respectively.

[0031] Each measurement result is shown in Table 1.

[Table 1]

		実施例1	実施例2	実施例3	比較例1	比較例2
重合液の 重合率 (重量%)	ST	97.6	98.0	98.2	44.5	95.8
	MAH	97.9	97.8	97.5	52.4	96.1
	MMA			97.9		
YI(イエローアインデックス)		1.85	1.92	1.90	2.22	2.27
分子量	Mw	146,000	151,000	153,000	143,000	152,000
	Mn	64,000	66,000	68,000	63,000	73,000
	Mw/Mn	2.28	2.29	2.25	2.27	2.15
総揮発分(ppm)		260	280	290	1380	570
最終組成比 (重量%)	ST	56.7	48.5	43.9	54.1	57.5
	NPMI	42.8	50.9	52.5	42.6	40.0
	MAH	0.5	0.6	0.6	3.3	2.5
	MMA			3.0		

ST:ステレン,MAH:無水マレイン酸,MMA:メタクリル酸メチル,NPMI:N-フェニルマレイミド

[0032] From an example and the example of a comparison, if a polymerization and imide-ization are performed not in multistage but in one step in manufacturing the imide-ized copolymer concerned, conversion and the rate of imide-izing will become low, and thermal stability will become [YI (yellow index) and the total volatile matter] high bad. Moreover, while cutting in long duration although the specified substance is obtained if it manufactures continuously and in batch, a color tone becomes [YI (yellow index)] high bad.

[0033]

[Effect of the Invention] This invention is very useful about the approach of excelling in thermal stability and a color tone, and manufacturing continuously an imide-ized copolymer with little total volatile matter with a high invert ratio.

[Translation done.]

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